

Update on Korean 300 MW IGCC Project

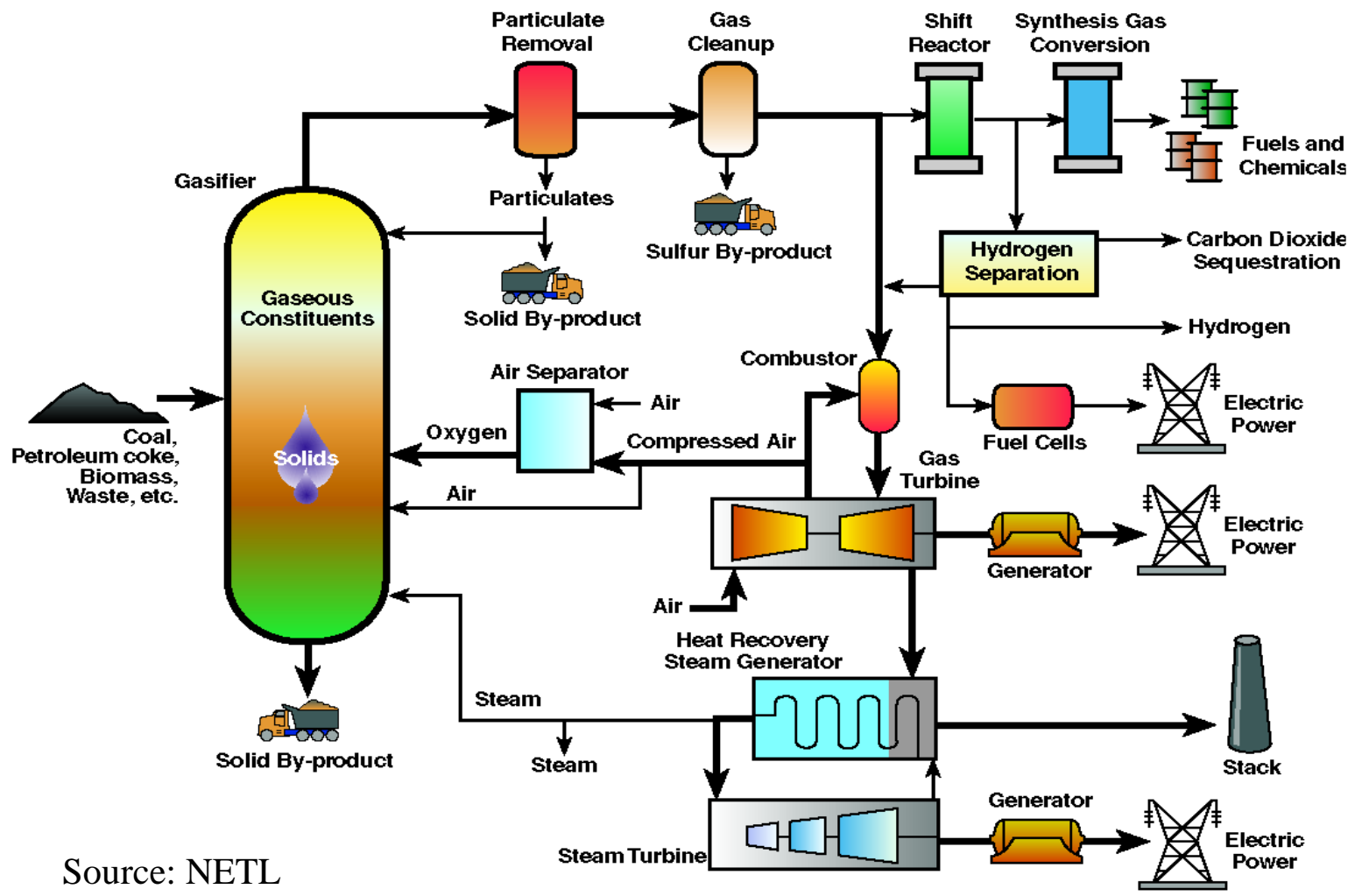
Korea IGCC RDD&D Organization



IGCC Overview


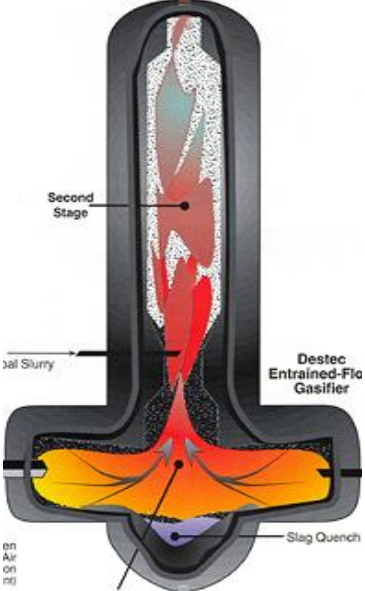
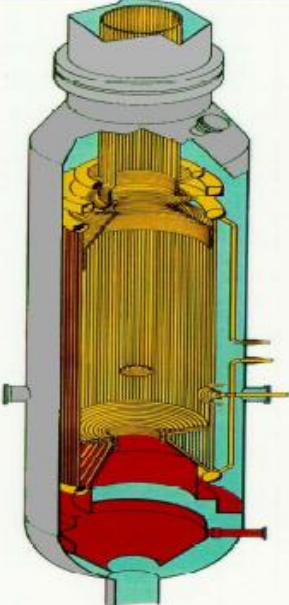
- Integrated Gasification Combined Cycle (IGCC)
 - Power plant **combining a Gasification system with a CC**
 - Coal is converted into a raw synthesis gas (syngas), mostly CO and H₂, in a gasification system. The raw syngas is cleaned and then used to produce electricity in a CC power plant
- Features
 - **High efficiency**: current 39~42% (HHV, Net)
 - Up to 45~46% with advanced GT
 - **Environment friendly** : SO_x 99.9%, NO_x 25ppm
 - **CCS Ready** : 90% of CO₂
 - **Flexible feedstock** : Coal, Biomass, Waste, Petroleum Residue
- Disadvantages
 - High capital cost, Complex configuration

IGCC



Source: NETL

Entrained Gasifier Types

GE	E-gas	Shell
<p>Single-stage, Downward, Slurry feed, Oxygen blown, Refractory lining, Radiant & Quench</p>	<p>Two-stage, Upward, Slurry feed, Oxygen blown, Refractory lining, Fire-tube boiler</p>	<p>Single-stage, Upward, Dry feed, Oxygen blown, Membrane wall, Water-tube boiler</p>
		

World Operating IGCC Plants

Plant	Year	Output (MW)	Feedstock	Technology
Buggenum	1994	253	Coal/Biomass	Shell (SCGP)
Wabash	1995	262	Coal/Petcoke	E-gas
Polk	1996	250	Coal/Petcoke	GE
Vresova	1996	350	Lignite	Lurgi (26)
Schwarze Pumpe	1996	40	Lignite/Waste	GSP
Pernis	1997	120	Vis. Residue	Shell(SGP)
Puertollano	1998	300	Coal/ Petcoke	Prenflo
Schwarze Pumpe	1999	75	Lignite/Waste	BGL
ISAB Energy	2000	512	Asphalt	GE
Sarlux	2001	551	Vis. Residue	GE
Chawan	2001	173	Residual Oil	GE
API Energia	2002	287	Vis. Residue	GE
Delaware	2003	160	Fluid Petcoke	GE
Negishi	2003	342	Vac. Residue	GE
Agip	2006	250	Visbreaker Residue	Shell(SGP)
Nakoso	2007	250	Coal/PRB	MHI

Source : GTC, World Gasification Database , 2008

Coal-based IGCC Demonstration Plant



Polk 250MW, US



Wabash 252MW, US



Buggenum 250MW, The Netherlands



Puertollano 300MW, Spain

Korea IGCC RDD&D Organization

○ Establishment

- **Established in Dec 2006** in order to facilitate the research, development, demonstration and deployment of IGCC program under the support of *Ministry of Knowledge Economy* (MKE) and *Korea New & Renewable Energy Center* (KNREC)

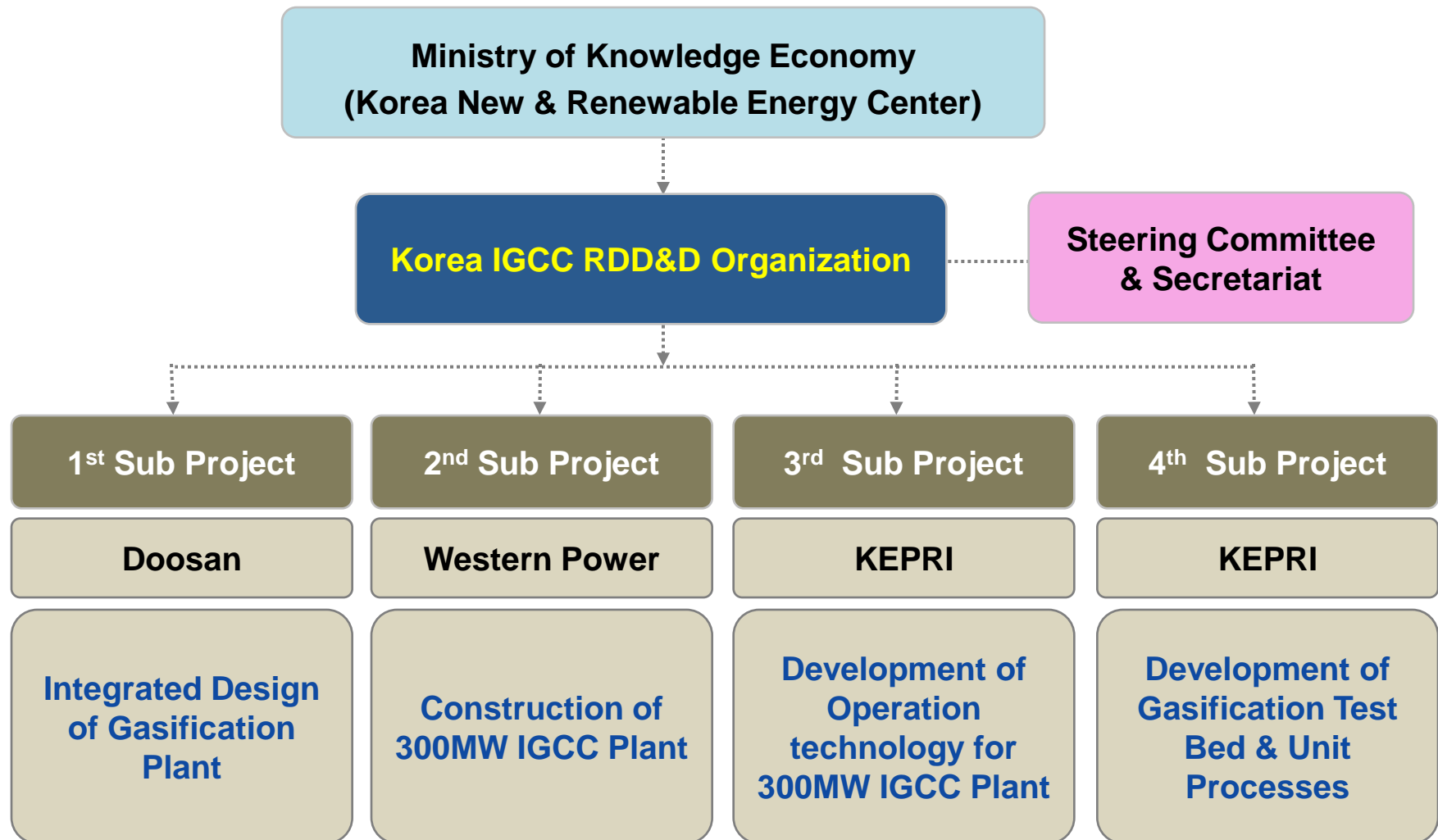
○ Background

- Achieve government policy goal of **increasing new and renewable energy use** in electric power generation **from current 2.5% up to 7% by 2011**
- Achieve “*Korea Electric Power Development Basic Plan*”’s goal of **constructing 300MW IGCC plant** by 2012

Overview of Korea IGCC Program

Title	Design and Construction of 300MW IGCC Demo Plant for the Development of Korea IGCC technology
Consortium Partners	<ul style="list-style-type: none">• Prime Contractor :<ul style="list-style-type: none">• Korea Electric Power Corporation (KEPCO)• Sub Contractor :<ul style="list-style-type: none">• Korea Western Power, Doosan Heavy Industries• Institutes (KIER, IAE)• Universities (Seoul, KAIST, ...)
Period	<ul style="list-style-type: none">• 2006.12.1 ~ 2014.11.30 (8 years)
Funding	<ul style="list-style-type: none">• Government : ~30%• Participant : ~70%

Organization of Korea IGCC Program



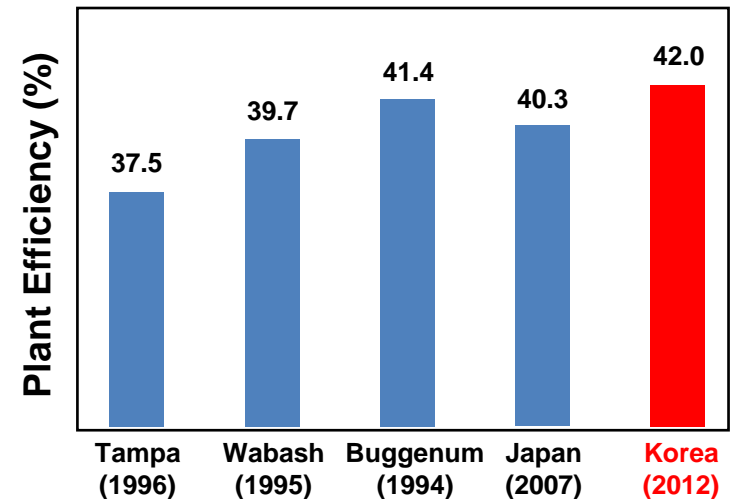
Objective of Korea IGCC Program

Ultimate Goal

- **Acquire world class IGCC technology**

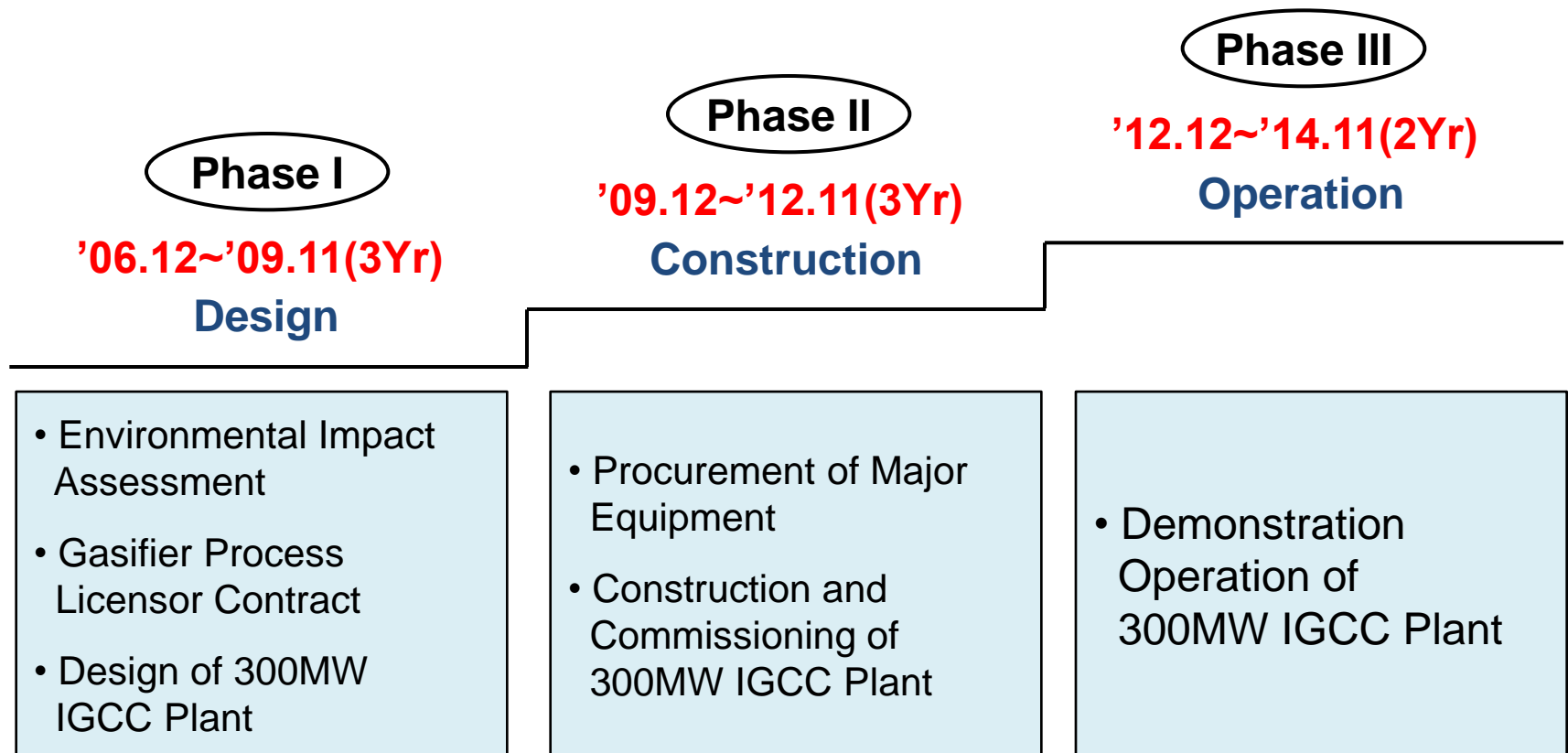
Quantitative Goal

- **Thermal Efficiency: 42%(HHV, Net)**
- NOx: less than 30 ppm,
- SOx: less than 15 ppm
- Localization of Engineering Design : >90%
- Localization of Facility Manufacture : >90%

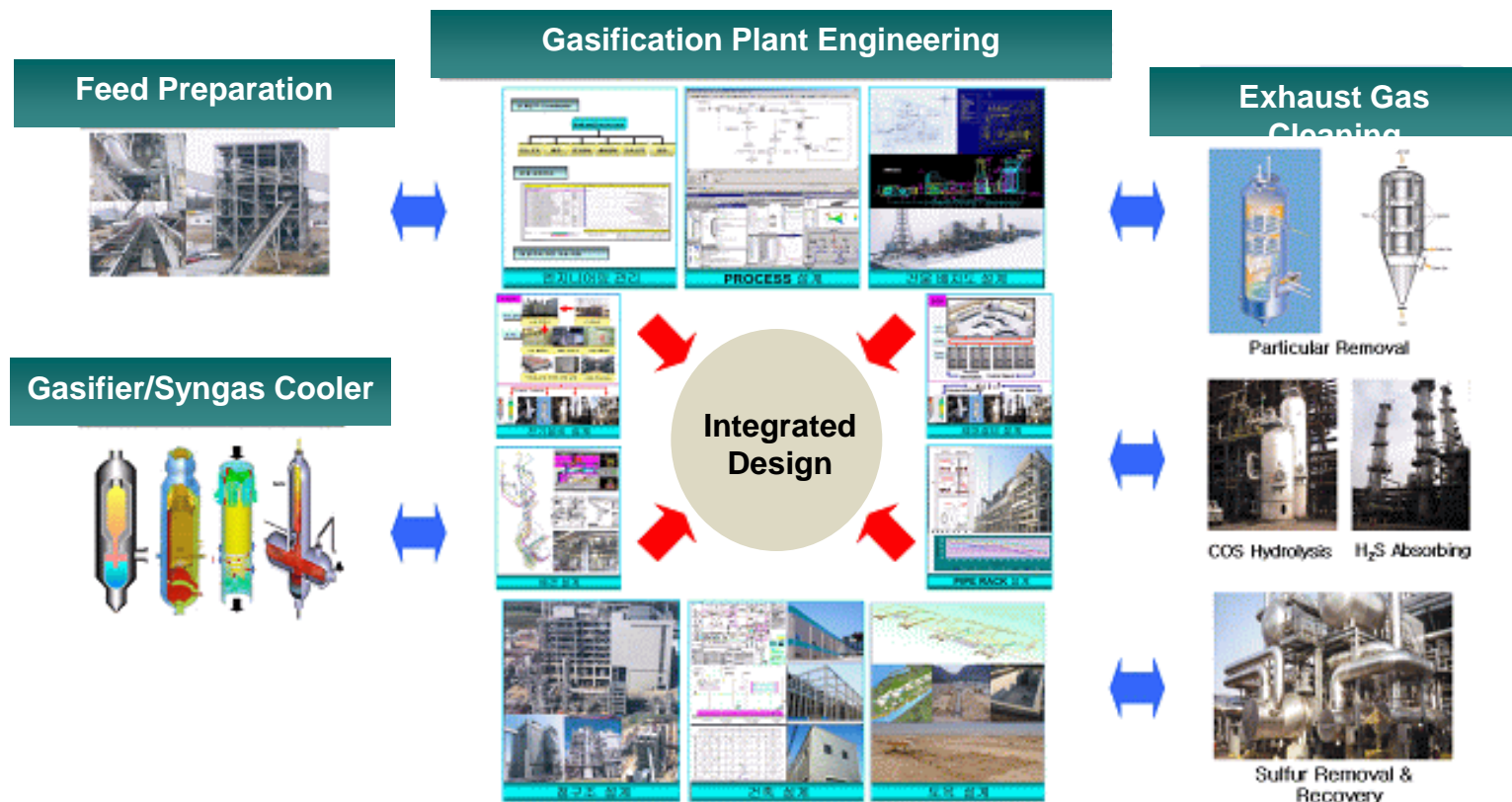


Construction of **World Best IGCC Plant**

Phase Description of Korea IGCC Program



1st Sub Project	Integrated design of 300MW gasification plant based on self-reliant development
Contractor	<ul style="list-style-type: none"> • Prime : Doosan Heavy Industries • Sub : Universities(KAIST, Yonsei)
Project Goals	<ul style="list-style-type: none"> • Engineering of Korea 300MW Gasification Plant • Self-Reliant Development in Gasification Process Engineering

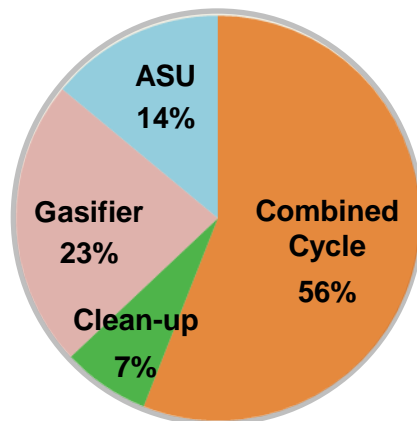


2nd Sub Project	Development of engineering, manufacturing, and construction technology for the 300MW IGCC demo plant
Contractor	<ul style="list-style-type: none"> • Prime : Korea Western Power
Project Goals	<ul style="list-style-type: none"> • Successful Construction of the most competitive IGCC plant in the world



※ October 2008, **Shell Coal Gasification Process** was selected as a gasification process

3rd Sub Project	Development of operation technology for Korea 300MW Class IGCC Plant
Contractor	<ul style="list-style-type: none"> • Prime : Korea Electric Power Research Institute (KEPRI) • Sub : Universities(Seoul, Hanyang, Inha, Hanbat, Kunsan)
Project Goals	<ul style="list-style-type: none"> • Development of operation technology of Korea 300MW IGCC plant to enhance the availability and reliability, and to save the maintenance cost



Forced Outage by Facility



Coal-Gas Combustion Test



Operator Training Simulator

4th Sub Project	Development of a gasification test bed and unit processes by domestic technology for the Korea 300MW IGCC plant
Contractor	<ul style="list-style-type: none"> • Prime : Korea Electric Power Research Institute (KEPRI) • Sub : KIER, IAE, and Universities(Ajou, Hongik, Suwon, Gyoungsang)
Project Goals	<ul style="list-style-type: none"> • Construction and run of the gasification test bed (max. 30T/D) • Trouble shooting of demonstration plant by using the test bed • Development of domestic design technology of gasifier parts



Gasification Test Bed



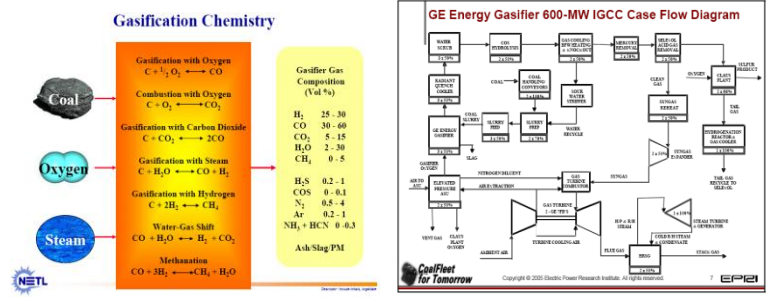
Gasification Facilities(KEPRI, IAE, KIER)

Benefits: Localization of Engineering Design (more than 90%)

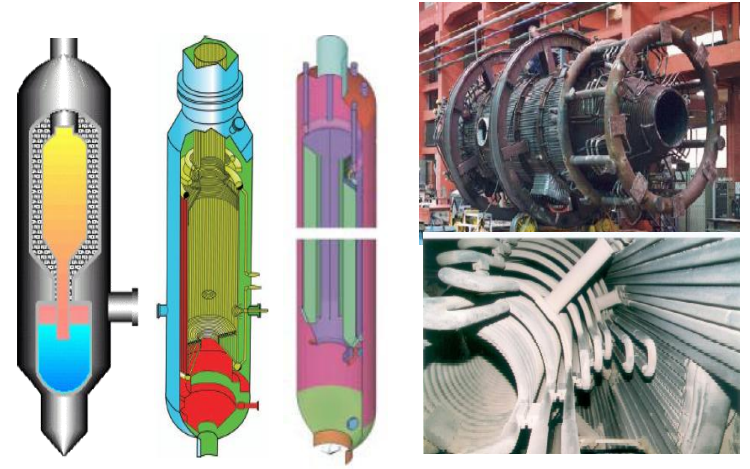
Basic & Detail Design for 300MW Gasification Plant



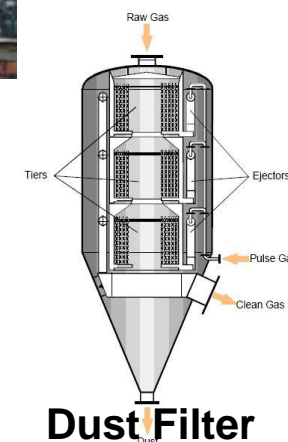
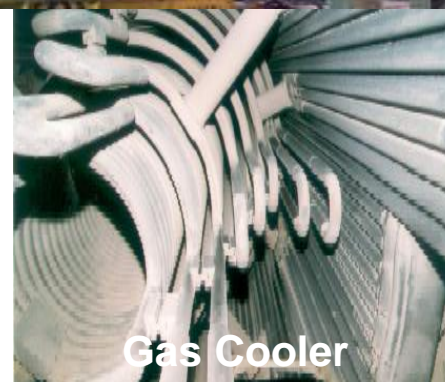
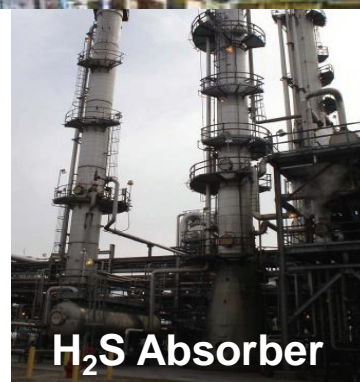
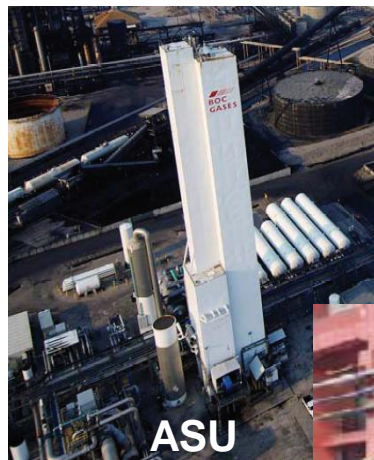
Gasification/Cleanup Process Design



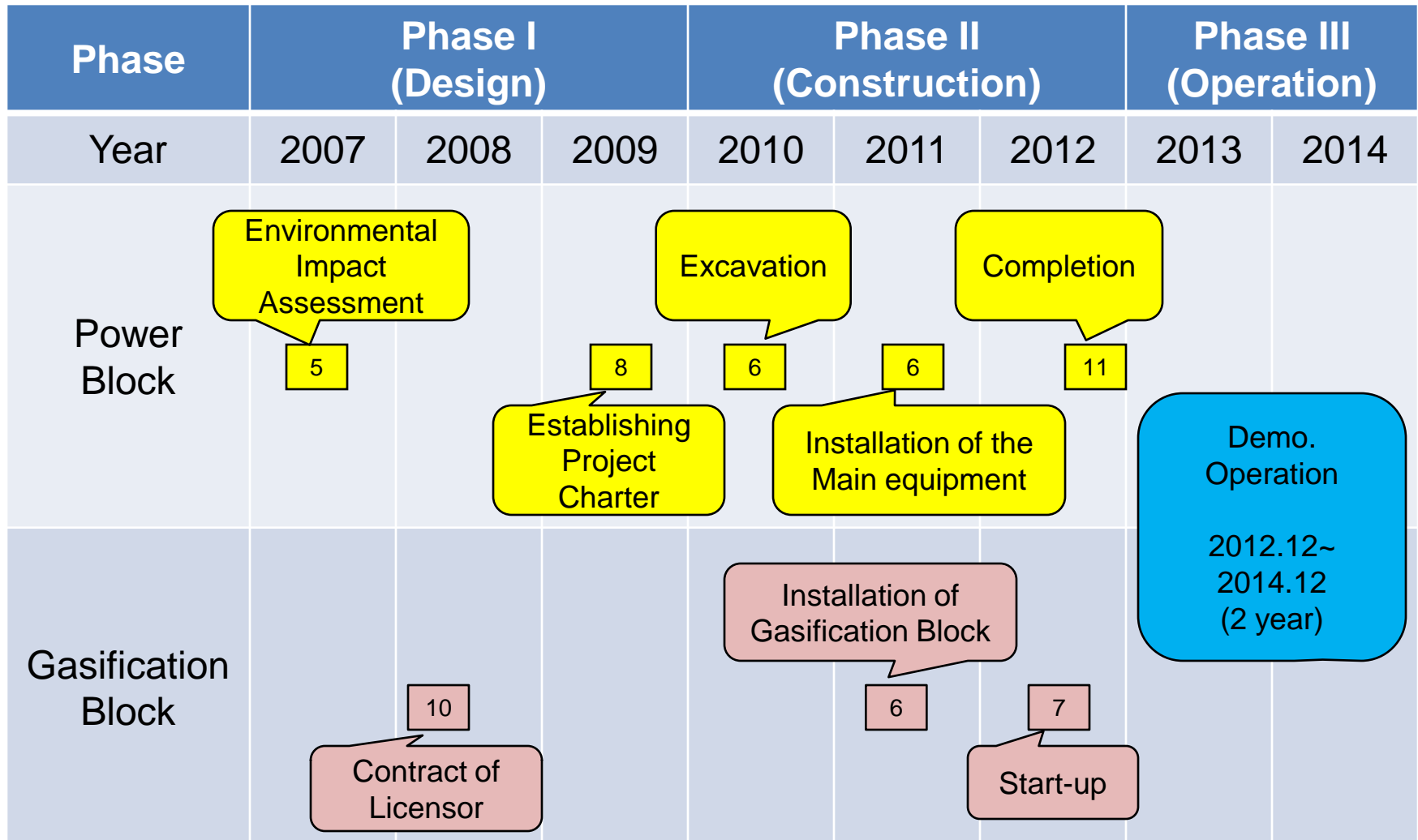
Gasifier Manufacture



Benefits: Localization of Facility Manufacture (more than 90%)



Milestone of Korea #1 IGCC Plant



Thank you